

REMARKS

This case has been carefully reviewed and analyzed in view of the Official Action dated 9 July 2001. Responsive to the rejections made in the Official Action, Claims 1, 11, 12, 13, 21, 23 and 24 have been amended to clarify the Claim language thereof and the combination of elements which form the invention of the subject Patent Application. Additionally, Claims 2-10, 14-20 and 22 have been canceled by this Amendment.

In the Official Action, the Examiner objected to Claims 11, 12, 21, 23 and 24 as being dependent upon a rejected base Claim, but the Examiner kindly indicated that those Claims would be allowable if rewritten in Independent form including all of the limitations of the base Claim and any intervening Claims. Accordingly, Claims 11, 12, 21, 23 and 24 have been amended to place those Claims in Independent form, including all of the limitations of the respective base Claim (Claims 1 and 13) and any intervening Claims (which there were none). Therefore, amended Claims 11, 12, 21, 23 and 24 should now be allowable.

In the Official Action, the Examiner rejected Claim 1 under 35 U.S.C. § 102, as being anticipated by Great Britain Patent Publication #2,088,544.

Before discussing the reference relied upon by the Examiner, it is believed beneficial to first briefly review the structure of the invention of the subject Patent Application, as now claimed. The invention of the subject Patent Application is directed to a heat exchanger which includes plurality of fins spaced from each other in parallel and allowing an air flow to pass through a gap therebetween. The heat exchanger includes a plurality of heat transfer

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tubes extending through the fins, and a plurality of vortex generators respectively formed on the plurality of fins and corresponding to each of the plurality of heat transfer tubes. Each of the vortex generators includes a plurality of protuberance ribs formed on a corresponding fin around a respective centrally disposed heat transfer tube. Each of the protuberance ribs has an arcuate contour in a plane normal to the respective heat transfer tube. The plurality of arcuate protuberance ribs together form a circular pattern concentrically spaced around the respective heat transfer tube. Each vortex generator includes an air flow inlet defined between an adjacent two of the protuberance ribs and an air flow outlet defined between another adjacent two of the protuberance ribs. By that arrangement, the air flow is guided from the air flow inlet, through channels defined between the plurality of protuberance ribs and the heat transfer tube, and passes out of the air flow outlet, thereby speeding the air flow, and generating vortexes at the protuberance ribs and the air flow outlet for drawing outer air to the heat exchanger for air mixing. The vortex generators of the invention of the subject Patent Application provide air circulation in the normally dead air space disposed in the downstream area behind each respective heat transfer tube, as well as drawing air external to the vortex generators into the vicinity of the heat transfer tubes.

In contradistinction, the Patent Publication #GB 2,088,544 discloses a heat exchanger having a plurality of parallel spaced plate fins 60 through which heat transfer tubes 58 pass, in respective cut-out portions 82. Each plate fin 60 is formed with raised surface members 86 which are disposed at an angle with respect to the local flow direction and between the

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columns of the tubes, Page 2, Lines 40-52. It is the intent of the vortex generators disclosed by this reference to form spiral vortices that, as they approach the heat transfer tubes, they are directed away from the heat transfer tubes to provide an air flow inwardly between the tubes, Page 2, Lines 73-79. The reference specifically states that "...the generated vortices should not interfere with the collar vortices developed about the [heat transfer] tube...", Page 2, Lines 99-101. Thus, the reference teaches away from the structural arrangement of the invention of the subject Patent Application, wherein the plurality of protuberance ribs are arranged in a circular pattern concentrically spaced around the centrally disposed heat transfer tube. In particular, the arrangement of protuberance ribs of the invention of the subject Patent Application is intended to eliminate the otherwise dead air space that lies immediately behind the heat transfer tube, despite any turbulence created by the collar surrounding the heat transfer tube. Still further, the reference fails to disclose protuberance ribs having an arcuate contour in a plane normal to the respective heat transfer tube, which plurality of protuberance ribs together form a circular pattern.

Therefore, as the reference fails to disclose each and every one of the elements of the invention of the subject Patent Application, as now claimed, it cannot anticipate that invention. Further, as the reference teaches away from the structural arrangement of the invention of the subject Patent Application, it cannot make obvious that invention either.

In the Official Action, the Examiner rejected Claim 13 under 35 U.S.C. § 103, as being unpatentable over the Great Britain reference in view of Japanese Patent Publication

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#JP61-006590. The Examiner admits that the Great Britain reference fails to disclose a plurality of inner protuberance ribs and a plurality of outer protuberance ribs corresponding to the inner protuberance ribs and centralized with a heat transfer tube. However, the Examiner relies on the Japanese Patent Publication #JP61-006590 as disclosing a plurality of inner protuberance ribs and corresponding outer protuberance ribs centralized with a heat transfer tube.

It is respectfully submitted that the Great Britain Patent Publication fails to disclose or suggest vortex generators formed by a plurality of arcuate protuberance ribs which together form a circular pattern concentrically spaced from a centrally disposed heat transfer tube, let alone a combination of inner and outer protuberance ribs, each grouping respectively forming concentric circular patterns.

The Japanese Publication #JP61-006590 does not overcome the deficiencies of the Great Britain Publication. In fact, the Japanese Patent Publication is not directed to a heat exchanger fin configuration with vortex generators. Instead, the reference discloses raised portions which are designed to simply redirect air flow to the otherwise dead air space disposed behind (downstream) of a heat transfer tube. The Examiner's attention is kindly directed to the Abstract wherein it clearly states that the cut-and-raised parts are disposed "along a curve smoothly deflecting the streamline of air flow" (emphasis added). As the raised structures disclosed by this reference are intended to **smoothly deflect** the air flow, such cannot be considered vortex generators, as they create no turbulence.

Arguendo, even if the structures were considered to create turbulent flow, the reference fails to disclose such structures arranged in circular concentric patterns around each of the heat transfer tubes. Still further, neither the Great Britain reference, nor the Japanese Patent Publication #JP61-006590 disclose or suggest inner and outer protuberance ribs which respectively extend in opposing directions. The Examiner's conclusion that the Great Britain reference makes such a configuration obvious by its disclosure that "it is possible to optimize the number of sets of vortex generator means as well as the configuration for each set", is without merit. It is believed that the Examiner reads too much into the above quoted statement. The configuration for each set refers to the angular arrangement of raised members, and the number of raised members associated with each set, and may as well include optimization of the spacing between raised members. But nowhere does the reference ever suggest forming raised members in opposing directions, extending from opposing sides of a fin. One skilled in the art could not possibly derive Applicants' arrangement from the Disclosure of the Great Britain reference. Further, as the reference teaches away from locating the vortex generators so that they effect air flow in the vicinity of the heat transfer tubes, a function which the invention of the subject Patent Application performs, such optimization can certainly not include any structural arrangement which in fact effects the air flow in the vicinity of the heat transfer tubes.

Additionally, it is respectfully submitted that the combination of the Great Britain reference and the Japanese Patent Publication #JP61-006590 is improper. As previously

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discussed, the Great Britain reference teaches away from any arrangement wherein the air flow in the vicinity of the heat transfer tubes is effected. Whereas the Japanese Patent Publication is directed to an arrangement which is designed to specifically effect the air flow in the area directly behind the heat transfer tubes, and to accomplish that through the use of air flow directors, rather than vortex generators. Thus, as the Japanese Patent Publication #JP61-006590 is directed to concepts in direct opposition to the teachings of the Great Britain reference, one skilled in the art would not look to the teachings of the Japanese Patent Publication #JP61-006590 for modifying the structure of the Great Britain reference. Neither the Great Britain reference nor the Japanese Patent Publication #JP61-006590 makes obvious the invention of the subject Patent Application, and even if combined, such combination fails to make obvious the invention of the subject Patent Application, as now claimed.

For all the foregoing reasons, it is now believed that the subject Patent Application has been placed in condition for allowance, and such action is respectfully requested.

Respectfully submitted,  
For: ROSENBERG, KLEIN & LEE



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DIK/ds